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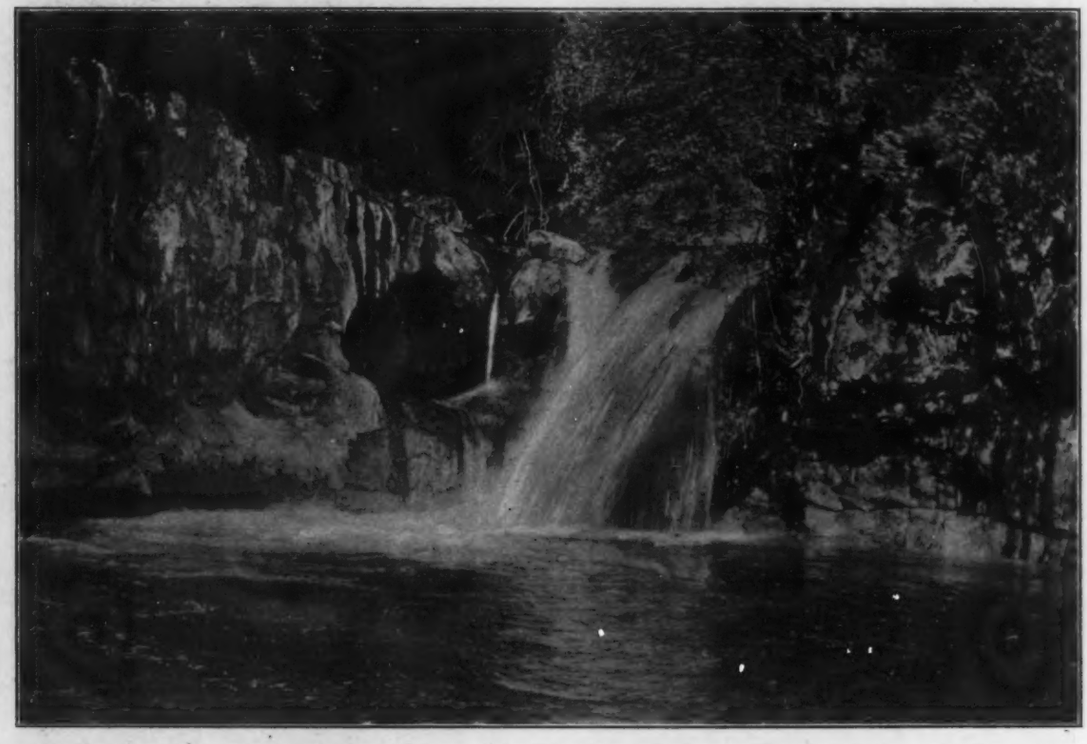
The Engineers', Architects' and Builders' News

VOLUME XIX. SAN FRANCISCO, CAL., OCTOBER 5, 1907 No. 14

POWER PLANT OF THE ARIZONA POWER COMPANY.

The Arizona Power Company is about to construct a power plant on Fossil Creek, fifty miles east of Prescott, Arizona. This plant is to be developed in two sections, having a capacity of about 6,000 continuous horsepower. The plant is unique in having springs as its source of water supply, carrying 43 cubic feet of water per second. This flow has been constantly observed for twenty-nine years, and has never varied perceptibly. During the last seven years the flow has been measured by engineers, and has been found to be absolutely constant. These springs flow from the ground at an altitude of 5,000 feet above sea level. The temperature of water is something over 75 degrees Fahr., which bears evidence that it comes from a great depth. This is also evidenced by its high mineralization, the deposit of these minerals being responsible for the name of the stream, Fossil Creek. No rainfall whatever is depended upon or used in this project.



SPRING FURNISHING WATER FOR HYDRO-ELECTRIC POWER PLANT

The company proposes to market its power in a rich copper and gold mining section, extending a distance of fifty miles, with Senator Clarke's famous United Verde mine, at the north, and the rich Crown King district at the south. The Humboldt smelter and the rich surrounding country are on the line.

The hydraulic construction will be mostly of tunnel work, with a large forebay at the head of the lower plant pipe line, containing 500 acre feet, 1,100 feet above the wheels of the lower power house.

A steel tower transmission line will connect the two plants and extend to the city of Prescott and through the principal mining districts. The tower line will have duplicate circuits for 45,000 volts. At stations along the line, current will be transformed to 10,000 volts, which will be used for distributing circuits on wooden poles to reach the small consumers.

The high price of fuel in this locality and the extraordinary scarcity of water, are special features of the market reached by the proposed lines. The cost of coal in the district varies from $4.25 to $5.50 per ton at the railroad

stations. Many of the mines haul this fuel up difficult grades, increasing its cost from 25 per cent to 100 per cent. Many mines haul water at great expense to use in boilers, or resort to the use of distillate at an expense of 23 to 25 cents per gallon.

GENERAL VIEW OF SPRINGS.

FOSSIL CREEK CANYON.

The most conservative managers of mines in this locality state that power is costing them over $200 per 24-hour horsepower per annum, based on the rating of the engines, and many admit that the power costs $300 on this basis.

The cities of Prescott, Jerome, Mayor and Humboldt will be served with light and power from this plant.

The cost of developing this project is estimated at $1,800,000, or $300 per horsepower. This high figure is, however, financially admissible on account of the extraordinary value of the power in this district.

The Electric Operating Construction Company, of 49 Wall Street, New York, and Union Trust Building, San Francisco, Cal., has entire charge of the construction and operation of the plant. Viele, Cooper & Blackwell, of New York, will act as consulting engineers.

REPAIRING THE CUP OF A TWO-LIFT, 500,000-CUBIC-FOOT GAS HOLDER.*

By Geo. S. Colquhoun.

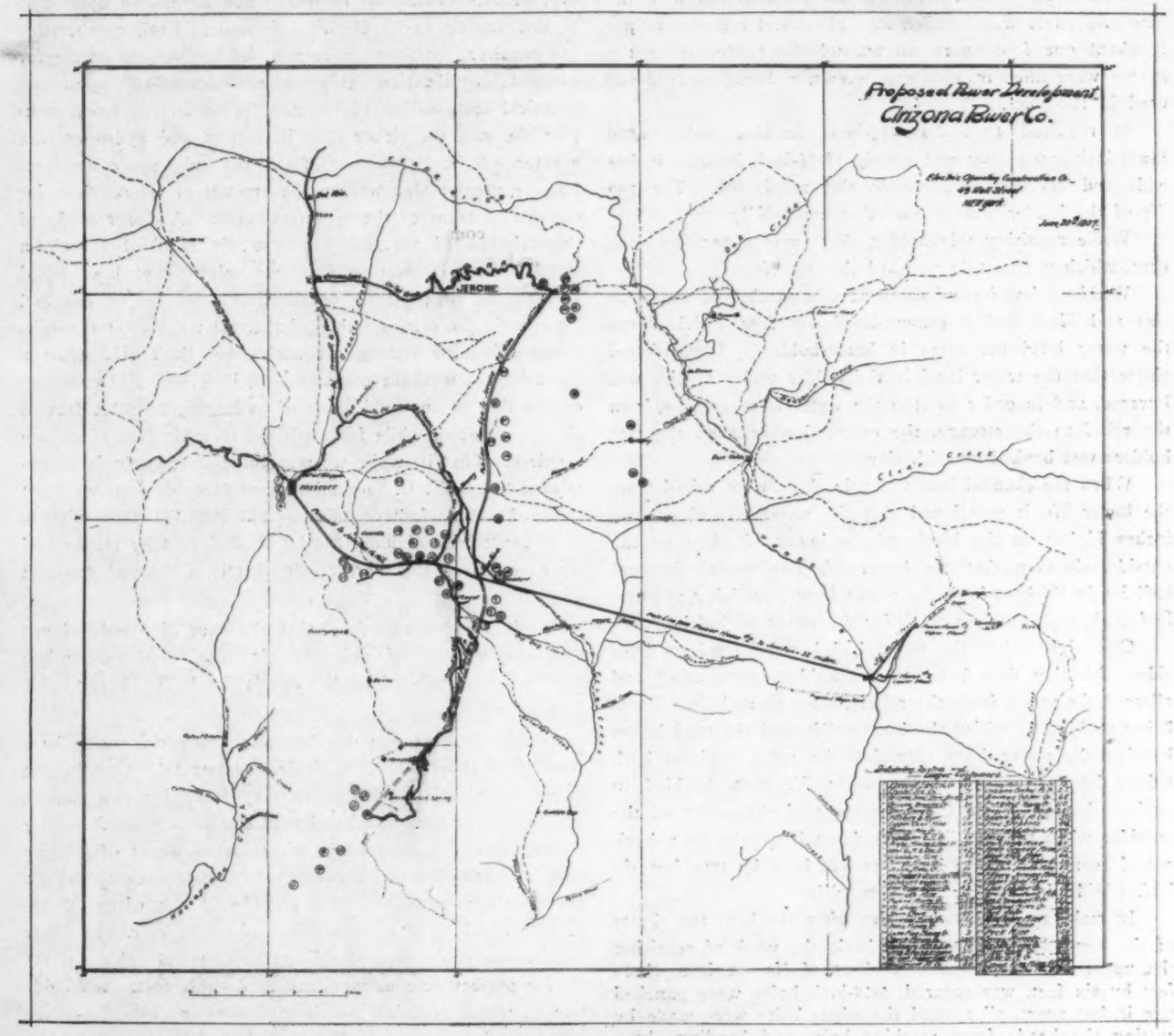
There is at the Potrero Station of the San Francisco Gas & Electric Company, a 500,000-cubic-foot, two-lift holder used for storage purposes, which was built in 1874, and the grip on the lower lift of this holder had, from long use, become badly corroded, just above the water line of the cup. The leaks had from time to time been patched with soft patches, using an iron clamp with red-lead putty between, but lately they became so numerous and large that it was decided to renew the row of sheets on the channel iron that forms the grip. The holder is built in a concrete-masonry tank, and the water level is about two inches below the top of the lower lift when it is down, which necessitated the lowering of the water in order that the men could work.

A block and falls was then rigged up to each of the guide-frame uprights, with a hook on the lower end reaching down and under the grip sheet, in order to hold the grip sheet and channel iron from falling after they had been cut loose from the lower lift.

The men were then set to work in pairs to cut the rivet heads; one using a hardy or side cutter and the other a light sledge hammer. After the rivet heads were cut off, we found some difficulty in driving the rivets through without injuring the top sheets of the lower lift, but after some experimenting, it was found best to pry the sheets away from the channel iron; for this work, each man used two long, slim, taper, cold-chisels, driving one down between two rivets and leaving it there until the other had been driven down between the next two, then drawing the first one and driving it ahead of the second chisel; this loosened the sheets without the danger of tearing them.

When the lift sheets were all loosened, the channel and grip sheets were raised by means of the blocks and falls, about three feet above the ground. The sheets were then marked as to their position on the channel iron, as it was found that the holes were not equally spaced, nor were they in line horizontally; so that each new sheet would have to be marked from the old sheet as a template. After this was done, the rivets that held them to the channel iron were cut in the manner mentioned before.

In putting the sheets on, red-lead paint and red-lead putty were used in the joint; 5-16-inch and 1½-inch machine bolts with a grummet on the head, were used to bolt the new sheets to the channel iron, the bolts being put through



MAP OF TRANSMISSION LINES.

* Paper read at 15th Annual Convention Pacific Coast Gas Association, at Santa Cruz, California, Sept. 17, 18, 19, 1907.

from the under side of the channel iron, thus leaving the nut on the outside. The vertical seams were riveted, as was also the bottom stiffening rod.

While the grip sheets were being bolted in place, some of the men were set to tapping the holes in the outer side of the channel iron, for ½-inch cap screws, and the holes in the top sheets of the lower lift were reamed, so there would be a little clearance around the sides of the cap screws.

This work being completed, the channel iron with the new grip sheet was lowered into place and cap screws put in about one foot apart, all around the holder; then the spaces were filled in with cap screws, red-lead putty being used in the joint.

It required 4,000 5-16x1½-inch machine bolts, 4,000 ½x¾-inch cap screws and a strip of ⅜-inch iron, 14 inches wide and 350 feet long, to do this repair job. The top lift of the holder was in operation continually.

While repairing this holder, there was a peculiar accident, which very nearly wrecked the top lift.

Within a few feet of the holder is another of the same size and kind, and a cement-lined overflow which keeps the water level the same in both holders. I mentioned above that the water level in the holder under repairs was lowered, and in order to stop the water from coming from the relief to the storage, the connection between the two holders was banked up with clay.

When the channel iron and grip sheet were raised from the lower lift, it was found that the water was about two inches higher on the inside of the lower lift than on the outside, showing that the lower lift was setting in mud sufficiently thick to keep the water from equalizing at once, in fact, it took nearly a week for the water to find its level.

One night, after the water had become level on both sides, the clay dam between the holders gave away and allowed the water from the relief holder to rush in. There being nothing to stiffen the bottom lift, and the mud below keeping the water from assuming the same level on both sides, the top sheets of the outer lift were buckled in against the top lift from the pressure of the water on the outside; when the top lift came down it caught on a horizontal seam and tore a hole five feet long by two feet six inches wide, in the side of the top lift.

In making the second repairs, after the bent top sheets of the lower lift had been tied back, the work of repairing the upper lift was begun. A sheet of No. 12 iron, three feet by six feet, was secured, 5-16-inch holes were punched two inches apart, all around the edge; bolts were made by cutting the heads from machine bolts and bending about one inch to ninety, leaving 1½ inches on the thread side, the threads being run down to the bend. The sheet was then placed against the holder over the hole with red-lead putty, between, and a hole drilled every eight inches, with a breast drill, and the bolts put in. The nuts were screwed tight, the bolt being held outside the nuts with a pair of pliers.

The holder was then raised slowly, and bolts put in four inches apart, on the vertical seam, until the bottom of the patch was reached, when there was some trouble to stop the gas, but, by quick work and the use of some putty, a sufficient number of bolts were put in to make it tight, after which, there was no trouble in putting in the balance of the bolts.

DETERMINING HEAT UNITS.*

By Frederick C. Jones.

The calorific value of combustible gases is always expressed, at least in this country, in British Thermal Units per cubic foot, the British Thermal Unit being the amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit. Each combustible gas has its own definite number of thermal units, depending upon, and as unchanging as its chemical formula. Each combustible gas requires, moreover, a certain definite volume of air for complete combustion, this volume depending upon the chemical composition of the gas. That is, the more complex the gas, the richer it is in carbon and hydrogen, the greater will be its number of thermal units per cubic foot: but the greater also will be the amount of air required for the development of these thermal units. A closer study of the relation of thermal value to air required reveals a singular and interesting fact, we might say, law; equal volumes of all perfectly combustible mixtures of gas and air contain the same number of thermal units. For example, a cubic foot of hydrogen contains 344 B. T. U., while a cubic foot of methane contains 1073 B. T. U. For complete combustion of one cubic foot of hydrogen, 2½ cubic feet of air are required, while for methane, 10 cubic feet of air are required. That is, while we must dilute the cubic foot containing 344 B. T. U. to a mixture of 3½ cubic feet, we must dilute the cubic foot containing 1073 B. T. U. to a mixture of 11 cubic feet; dividing 344 by 3½, and 1073 by 11, we find we have almost the same result, that is, a thermal constant of 100.

It is evident, therefore, that the sum of a unit of gas plus the number of units of air required for complete combustion multiplied by 100 equals the B. T. U. per cubic foot of the gas.

B. T. U. then may be determined experimentally in a very short time. In an explosion burette take 10 c. c. gas under examination, add an excess of air for combustion, say 70 c. c., explode, cool and read the amount so that after passing into the phosphorus pipette the excess of oxygen may be read. Say this excess was 2 c. c., the excess of air. then in the mixture was 10 c. c. The 10 c. c. of gas therefore required 60 c. c. of air instead of 70 c. c. In other words, one cubic foot of this gas requires 6 cubic feet of air for perfect combustion, making 7 cubic feet, each cubic foot of which contains the thermal constant 100. 7x100, or 700, is the amount of B. T. U. contained in this cubic foot of gas. Practice has confirmed the correctness of this law, although, if the B. T. U. were under 100, as is the case with lean producer gas or blast furnace gases, this law will not apply.

Although there are cases in which this method does not hold, leading me to think that the thermal constant has not properly been determined, still the object of this paper has been attained if a step has been made in the right direction.

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* Paper read at the 15th Annual Convention Pacific Coast Gas Association, at Santa Cruz, California, Sept. 17, 18, 19, 1907.

PRACTICAL SUGGESTIONS FROM A PRACTICAL MAN.*

By Stephen A. Byrne.

It should be the aim of gas companies to endeavor to run their plants twenty-four hours per day, and sell gas in large quantities every minute of the twenty-four hours. To do this, the companies have for years strived, and still the big day consumption of gas has not materialized. Advertisers, stove and appliance manufacturers, theoretical gas men, and many others, get money out of the gas business, and why should not the company which produces the gas also make money, and at the same time make the people, without expense to the company, advertise its business? To do this, should be the aim of all managers.

I will now endeavor to offer a few suggestions which have occurred to me in the past sixteen years, while connected with three gas companies, and also from observation of the methods of the others in their dealings with the public.

To begin with, every one connected with the company, from the president down, should be imbued with the spirit of loyalty. They should be loyal to the company which employs them, and loyal to each other. Managers should endeavor to gain the confidence of the men employed under them, by fair treatment and living wages. They, in turn, by their loyalty to the company, will gain the confidence of the consumers, and make the management a success. To managers, I would say, never permit yourself to think that you are the whole cause of the success of your company, but at all times remember that, without the co-operation of the men under you, your management will be a failure. I do not mean by this that you should become too familiar with them; you can have a pleasant word with them—it costs you nothing; you should know them, study their peculiarities, and not be carried away with your own importance or everlastingly impress upon them the fact that you are the manager. Be friendly with them, but always firm, and keep them in their places; tolerate no undue familiarity. Once they get the idea that you are fair, and intend to do what is right by them, their opinion is formed that you are a "good fellow," and their heart is in the work. Their burden is lighter and success marks your every effort; but let them get an idea that your head is swelled, they will have no interest whatever in the success of the company. What they are then after, is the day's pay, with as little work as possible. Now, what is the result? Complaints—one of the hardest things any gas company has to contend with, which not only adds to the cost of distribution, but injures the very business in which capitalists have invested their money and are paying you a good salary to build up. The good work that you do will slowly, but surely, manifest itself; but complaints and poor workmanship travel so fast, it is impossible to catch up with them. For example (and every gas man will bear me out who has had any dealings with the public in the houses where gas is consumed): Take it in a district where entire blocks are solidly built upon, "Mrs. Complainer" has a poor light, or her meter was over-read; the bill is high; she calls "Mrs. Will Complain," and informs her. "Mrs. Will Complain" suddenly finds that she has a grievance. They compare notes, and decide to visit the company's office. Several others overhear the conversation; the result of which is a dozen complaints resulting from this one, and the company suffers by reason of the detrimental advertising it gets through the carelessness of an employee whom it has paid to properly do its work.

San Francisco has now what is known as the "Gas Workers' Union," and I believe the company is paying wages as per schedule submitted by the Union. On reading a copy of the schedule, I was somewhat surprised to find that gas was now being supplied consumers by an army of "Specialists." It reminded me of a French dinner bill of fare. We now have pump men at so much per diem; meter men at so much per diem; service men at so much per diem; appliance men at so much per diem. In the new make-up I hardly recognized the business of other days. However, one thing on the schedule was overlooked: they neglected to mention the "old-fashioned fellow," who could do anything—run a service, set a meter, attend to a complaint, and, in fact, do anything, when called upon. This, in my way of thinking, is all wrong. If it is necessary to pay the schedule price of $3.75 per day for a meter man, procure the best. Endeavor to obtain one who can do anything that he is called upon to do. This idea of sending out men who are not qualified to do anything necessary with either service or meter, is a risky proposition. When it comes to disconnecting a service or meter, an experienced and careful man should do the work. Explosions are costly; asphyxiations are possible, and it is a certainty that a complaint will be on file in the near future.

Another proposition union gas companies have to deal with in San Francisco, is the plumbers and gas fitters, who claim certain rights, which properly belong to the gas company. This is the service run between the walls and used for distributers. The Plumbers' Union claims the right to run all the pipe in a building, whether the same is used for a service or house pipe. The company is permitted to run the service from the main into the basement, and no farther, and must connect on to the balance of the service pipe run by a member of the Plumbers' Union. Now, it stands to reason, that a man who has never set a meter, or in any manner had to deal with complaints, is not qualified to install service pipes and distributers. In the first place, he does not know what size meter it will take, nor the measurement of the various meters. The result is that the meter man is compelled to either tear out plaster or make the pipe, as run, answer. The result is that connections become trapped and meters are set in an unworkmanlike manner.

Now, I propose a remedy for this condition of affairs: Where there is but one company in the field, that company can make its rules and compel builders to comply with them, or refuse to set a meter, on the ground that it is unsafe and dangerous to life and property, irrespective of any ten-day law that compels them to supply applicants for gas, as I will endeavor to explain.

Where there is an opposition company in the field, conditions entirely change, and in their "mad" fight for business, they allow themselves to become a prey to not only consumers, but builders, as well. Heads of departments do not seem to realize that the more they give away to retain a consumer, the more they have to give away, whether it is in gas, employee's time or gas appliances; it is all money. The remedy is, where such conditions exist, for the heads of both gas companies to get together and, between them, draw up a set of rules to be followed by architects and owners, compelling them to extend the house risers into the basement. Have a room or place set aside, properly ventilated, where a statement-taker can read the meters, or, in case of a fire, the company has some chance to remove them and shut off the gas. San Francisco is at the present time being rapidly rebuilt; contractors are taking every advantage of the gas companies; risers no longer extend into the basement; meters are set on the various floors, in the most out-of-the-way places. The result is, statement takers lose time hunting them up. The door being locked, he cannot see the meter, the result of which is a skipped or guessed-at statement. Another trip is necessary; bookkeeper behind in his work, and bills irregular, which is

* Paper read at the 15th Annual Convention Pacific Coast Gas Association, at Santa Cruz, California, Sept., 17, 18, 19, 2907.

some may be fast, some slow, etc. It is as bad for a gas another source of complaint. I claim that it is not only dangerous and costly to install meters as they are now installed on the various floors in apartment houses, but entirely unnecessary, in so far as the gas companies are concerned. It is up to them to get together and force the builders and owners to find a suitable place in the basement for all meters, which would then do away with plumbers running gas-service pipes, facilitate the taking of statements, and in many ways remove many of the chances the companies now take setting meters in bed-rooms or other out-of-the-way places. Another thing against service pipes being run by plumbers, is the fact that no provision is made for an opposition company, consequently, but one pipe is run in the building to be connected up with service from the street; the result being that but one company, the one which gets its meter in first, has any chance; and, while there may be twenty families in the house, and nineteen of them should want another company's gas, the other one could refuse to change, and force the nineteen others to make use of the gas they do not want. Have the meters in one place.

If owners or tenants insist on meters being set on the various floors, let them be intermediate meters working off the house meter, and hold the landlord for the bill. Cut out making presents of Welsbach lights, etc., to hold consumers when opposition companies make their appearance. Guarantee them courteous treatment, a good quality of gas at a fair price, and no more. As it is at the present time, they expect companies to run pipe and "dance attendance" on them, or they threaten to change. It has become a common thing in the opposition district to see solicitors for the gas company follow up furniture wagons to get new business. Solicitors will next be required to lay carpets and move in the furniture if the companies do not come to some understanding and prevent customers from working them. If it is the intention of one company to shut off a consumer for non-payment of bill, it should notify the other company so that the consumer cannot change until his bills are paid. If a consumer will not pay one company, he certainly will not pay the other.

It should be the aim of gas companies to maintain a strict watch over the candle power and pressure, and at no time allow it to get below a certain standard. Direct communication by telephone between the uptown offices and the works should be had at all times, as upon this point depends much of their success. If the pressure gets too high, regulators refuse to work properly, quicksilver is blown out, causing leaks, and globes are broken. A blowing of gas at the burner has a tendency to turn light into heat, and a blue flame is the result. If the pressure is too low, gas stoves and appliances refuse to work, resulting in consumers becoming dissatisfied and blaming the quality; Welsbach lights have to be readjusted, causing much annoyance to consumers and getting them disgusted with a light that can do much to increase the sale of gas. Consumers' gas appliances are regulated to the pressure at the time said appliances are set up, consequently any change causes a readjustment of every appliance in use on your lines. It should be the aim of gas companies to promote the use of gas appliances and not make consumers disgusted with their use. This is one of the ways to secure a good day, as well as night, consumption of gas. Watch your pressure. About five inches of pressure throughout the city at all times would be sufficient and do much to prevent meters leaking in the stuffing boxes and dials. Gas holders located throughout the city, with independent lines leading to them from the works, would do much to steady the pressure. Holders could be filled during the day, and consumers in the various districts supplied. By this means an even pressure could be maintained. Gas meters should be tested separately, and not in batches. Where an average is struck, company to send out a slow meter as it is to send out a fast one. You cannot keep a woman's tongue still even with a slow meter. If it happens that she has a slow meter and her bill is small, she seems to take delight in telling her next door neighbor and every one else; the result is that you have those same neighbors visiting your office, making a "high bill" complaint, and at the same time telling you all the gas Mrs. "Slow Meter" used compared with what she used, and what she paid and what they pay. Be sure of every meter you send out, and the only way to do it is to test it separately, and carefully inspect it for leaks. Use gas for testing, so that any bad action may be detected and future complaints and change of meters avoided. Measuring gas is the condition under which the meter is going to work, consequently it should be tested with gas. Deposits on meters are absolutely necessary with some people, and where there is more than one company in the city, some understanding should be arrived at for their own protection. With a property owner or a person known to the company, no deposit should be required; but people who move in and out should be required to furnish a responsible guarantor or made to pay a deposit. Collectors should be prompt in collecting regular bills and give special attention to closing bills. If your collector notifies a consumer to pay by a certain day or be shut off, see that the notice is carried out. He, being on the route, is the best judge of who is good pay and who is not. If notices are lived up to, consumers know that they mean what they say, and always pay attention to them. If you are careless, they get careless; the result is that their meter is shut off when least expected. If your notice is a bluff one month, have they not reason to think they are every time one is left?

Gas companies should keep an accurate record of all meter measurements as to size, length of connections, etc., and have a special book made for same. This is a very easy matter for any company to handle. As a new meter is set, or an old meter removed, have the meter-man turn in the measurements. These can be entered up, and in the event of an order again being received, a meter-man will know exactly what size meter and connections are necessary, and possibly save thousands of dollars in time and stock. If a meter-man is sent out each time to get a measurement, much time is wasted. If, on the other hand, he must take a guess measurement, what is the result? He does not intend to get stuck; therefore he takes out the longest lead connections he can get hold of, fills his pockets with an assortment of fittings, nipples, etc., and proceeds with the job, determined to set the meter any old way, so long as it passes gas. Possibly he has taken one foot more lead, at so much per pound, than was necessary, and the Lord knows how many unnecessary fittings are thrown away. Again, what is the result? Complaints. As before mentioned, the guess measurements had to go; the unnecessary lead was twisted and trapped so badly that complaints continued to come in from the consumer until the meter was finally removed. The same is true where wagons are used, in so far as trapped connections are concerned. As they also carry a limited assortment of lead connections, they must also make whatever connections they may have with them do. Fifty per cent of the complaints come from trapped meter connections. The same means should be taken to keep an accurate record of service measurements. A large percentage of the complaints of trapped services comes from the service being run in an unworkmanlike manner. It becomes a very costly service if it must be pumped out every month. Also, take into account the annoyance a consumer has to put up with, trying to use gas through a trapped service. To avoid complaints, and in a manner bring about a good feeling between consumer and gas company, and also reduce the cost of distribution, the company should take hold of the complaint as a surgeon would a sick man. When you find a complaint arises from a trapped service or meter connection, **cut it out.**

REPORT OF EXPERIENCE DEPARTMENT.

Pacific Coast Gas Association, Sept. 18, 19, 20, 1907.

Mr. President and Members of the Pacific Coast Gas Association.

Gentlemen: According to the time-honored custom, the High Priest of the Experience Department herewith makes his "ancient sacrifice," but this time he does so, as the poet puts it, with "an humble and a contrite heart." The offering, he fears, is too slim to propitiate the Gas House Gods, and he appeals for amnesty at the hands of the dieties. Oh, grant his prayer! Asphyxiated be those who escaped the knife of the Experience Man! There has ever been a strange similarity between the report of the Experience Department and a prepayment meter, and it is simply this: People are always curious to see the contents, but they hate to insert anything. This similarity is by no means startling, but it suggests a peculiar inconsistency in the character of the gas man, namely, that he is forever trying to induce people to make an insertion in the prepayment meter, but can not be induced to make an insertion, himself, in the analogous Experience Department Report.

To continue the figure of speech, I will say that there have been a few exceptions where the gas man has made an insertion with apparent willingness, and these exceptions we will take up now, first thanking those who have contributed and those who replied to the solicitations for contributions.

Experiences with advertising have been but few of late, perhaps owing to the fact that the necessity for advertising has rapidly diminished, owing to the growing popularity of gas. But here is one that will prove of interest.

Cook with Gas.

"This company was among the first companies to adopt the slogan, 'Cook with Gas,' and we have made it our advertising cry early and often.

"We advertise in two ways—in the local papers and by giving away suitable novelties.

"We find that small advertisements in the papers do not attract the attention of the dear public, so we seldom use less than three columns in width and oftentimes four columns in width, and many reading notices. We are carrying an ad in each of the three daily papers, which is four columns and eight inches in depth, and we change the copy according to circumstances. The weather has much to do with the change of copy.

"The company has found that advertising pays, if it is done right, especially novelty advertising. Through the distribution of novelties and various other channels, our employees are known all over the city (we have now about 35,000 inhabitants) as 'Cook with Gas,' and it is a little embarrassing at times to be guyed by the small boy, 'Here comes "Cook with Gas,"' when enjoying a stroll with one's best girl.

"We started the novelty advertising with lead pencils, then followed with numerous other specialties, among them egg timers, gas stove matches, badges, small looking-glasses, iron-holders, transfer pictures, toothpicks, thermometers, and, lastly, horse blankets.

"We had a hard time getting the loud yellow horse blankets distributed. They appeared ever too loud, even to the expressmen and other drivers. The big black letters with the yellow background could be read almost a block distant. We realized that this sort of advertising would bring good results, and at first found it necessary to hire the expressmen at one dollar per week to use them, but at the end of two weeks the assessment was stopped, as we could not supply the demand. This summer we have fifty different vehicles on the streets, which carry the loud yellow blankets adorned with 'Cook with Gas' in 12-inch letters. Even the city water wagons are so branded.

"The small badges with 'Cook with Gas' are in demand by the children, and a regular string of youngsters apply at our office daily for them."

Here is another experience of, perhaps, equal interest, but of a different nature:

Leak in Inlet Pipe to Relief Holder.

"Recently a severe leak manifested itself in the inlet pipe to our relief holder, and for quite a while it gave us a merry time. It showed itself in the afternoon after the line had been steamed, and was obviously a very bad one from the fact that we had to put on day and night shifts with a No. 4 Douglass pump in order to keep the water down in the drip-pot and allow the passage of gas.

"We immediately put a gang of men at work laying a pipe line to another holder, which we were to use as a relief holder, and also began digging down to the drip-pot, eighteen feet below the surface. Upon reaching the drip-pot we put into service a steam pump to keep the water below the outlet pipe from the drip-pot, and thus got rid of the men on the hand pump.

"It had for some time been our intention to replace the then existing pipe-lines with larger ones, and this we decided to do at once, in that way finding the leak. Accordingly, we proceeded to pump out the holder.

"When the water was removed, and we were drilling through a 24-inch wall in the bottom of the brickwork, we found the leak at the bell on the elbow of the riser. The lead was found to be nearly out of the joint and very loose. From the appearance, it would not have been long before it had entirely slipped out, and the pipe-line would have been flooded and we put out of business."

And now we follow with an experience of very peculiar interest.

"There's Many a Slip."

"Here is an experience for which the flood of the Feather River of last March is responsible.

"After the flood we found ourselves with one gasholder totally destroyed, and another with guide frames gone, besides numerous small leaks and some indentations in the holder itself. The holder was an old one, and we had some misgivings in the matter of straightening out the indentations. We had, however, erected temporary guide frames and had the holder raised up about half way out of the tub by means of specially made hooks grasping the lower rim of the holder, which was then raised by block and tackle. It was at this point, while we were getting ready to force out the sides of the holder to their proper shape, that one of the blocks holding up the holder gave way, causing the other blocks to do likewise, and the holder dropped back into the water of the tub. The air inside of the holder was naturally compressed with great force, and in a fraction of a second we had the sides of the holder all out to their proper places—doing gently and efficiently what we were preparing to do at a considerable expenditure of time and money."

The experiences of the meter man are often humorous, sometimes ridiculous, but rarely pathetic. We have here one that is pathetic in the extreme.

What Wifie Didn't Know.

"During the summer vacation period, a richly dressed woman who lives not far from down-town rustled into the office, and tapping nervously on the counter, seemed to be choking to hand a bunch of conversation to somebody connected with the corporation. She could hardly wait for the young man to wait upon her and poured her story into his ears in Maxim-gun style.

"'Oh, I've been waiting for a chance to catch you in How about this?' she demanded, throwing a bill for $3.00 on

the counter. 'Three dollars for gas which we never burned!'

"That is a very commonplace occurrence, and the clerk argued gently with her, but she was adamant.

"'We never, never burned a dollar's worth of gas this month,' she insisted. 'I was away at the seashore. My husband was home all alone—just slept in the house nights, got his meals down-town—and he told me that he had not burned the gas except just long enough to get undressed and go to bed. Those figures are all bosh! You just write them down and charge whatever you want to!'

"That was where the meter came in for its own. She was assured that that meter would be promptly investigated. The investigation seemed to uphold the meter, according to the inspector's report, but the lady only sniffed suspiciously and declared her original intentions to refuse payment. But it so happened that a gas company employee who heard of the matter had an intimate acquaintance with Harry, the husband, who only burned gas to retire by.

As a result an inspector sought him out at his office. And the brazen man grinned at the inspector and said: "'Sure, I'll pay the bill all right, but don't say anything to the wife.'

"He had little parties every little while during his wife's absence, and things that look like peppermint lozenges had clicked merrily until 3 or 4 o'clock in the morning, while a group of men about a table talked about 'kitties' and other animals.

"But the lady in question is still going about among her friends and telling that both she and Harry utterly refused to pay the bill, and the gas company stopped sending it."

Red Lead as a Preservative.

"Some time ago the writer was called upon to take charge of a strange plant, and among the improvements which he found it necessary immediately to make was the renewing of 2300 feet of main, because of severe leakage.

"The pipe in question was 3-inch screw tubing, and had been in the ground, report said, for a year and a half. Upon taking it up we found an average of 23 leaks to the length; and in many places the rust had eaten large ulcer-like holes into the pipe. The pipe had plainly been painted with red lead, but this had to a large extent been eaten away, or clung to the pipe in loose scale. The soil was of a lime composition, with perhaps some saline matter. As a substitute for the painted pipe we used galvanized iron pipe; but this has not been in the ground long enough to judge of its comparative durability."

The trials of the gas man are many, and it is little wonder that his life often becomes embittered and his disposition spoiled. We have here an instance where even so honorable and reputable an institution as a city police department fails to escape the wrath of the gas-monger.

Prepayment Meters Abandoned.

"At a meeting of our association some years ago, I gave you an experience that I had had with prepayment gas meters, and I strongly advocated the use of same on account of the easy collections from bad pay customers, but I must say that the time has come when I have had occasion to change my mind. Were it so that everyone were honest, I would still be strongly in favor of their use, but in our city, during the last year, we have had over 200 meters robbed. In some cases we suspect the parties living in the houses in which the meters are set, but in most cases they are down-right burglaries, houses broken into, here, there and everywhere. Had we adequate police protection it would be different, but living in a city where the police can only arrest someone who has left a horse untied, has speeded an automobile, or committed some other such petty offense, and where they very seldom arrest a burglar or robber, I have come to the conclusion to discontinue their use, to a great extent."

It takes the gas-house superintendent to get around a difficulty. Witness the following:

Quick Repairs.

"One of our water-gas 'Springer' sets burned the lining out of the firebox on New Years Day. We had no time for ordinary repairs to the generator so it was a question of immediate repairs. After a consultation of a few moments we decided that it must be done without delay. We immediately pulled out the fire and made, of sheet asbestos, doubled, with an air cushion between, a protection from the heat above. We then placed electric fans at the ash doors and with a relay of masons replaced the lining, covering an area of about 10 square feet. In spite of the tremendous heat and the confined limit in which we were able to work, we started the fire in this machine at 1:30 A. M., January 3rd, and in this manner were making gas again on the morning of the 4th.

"We had no further trouble with this machine, and the hurry-up patch is still in good condition."

We have another experience that may be of value, directly or indirectly, where a high-pressure system is in use.

High Pressure Expediency.

"The use of high-pressure tanks for distributing purposes offers a large field for expediency—a fact that was brought home to the writer some time ago with a great deal of profitableness.

"A certain plant used three compression tanks from which the mains were supplied at a pressure of 15 pounds. The tanks themselves were maintained at a pressure of 60 pounds each, that is, so far as this could be done by keeping an eye always on the gauges, and manipulating, as occasion demanded, the throttle on the steam end of the compressor. It occurred to the writer that the economics of such a system was open to considerable improvement, and changes were made along the following lines:

"First, the piping was so altered as to allow for the use of two of the tanks for storage and one for distributing purposes. The pressure to be maintained in the two storage tanks was made 80, instead of 60 pounds, and that in the distributing tank set at 15 pounds. The arrangement necessitated, of course, the recharging of the storage tanks, after discharging the gas during each peak load. But the economy of the arrangement lies in the fact that a constant pressure of but fifteen pounds was required for distributing, instead of 60 as formerly. In addition, we found that the former pressure of 15 pounds under which gas had been distributed, was more than adequate, and we consequently reduced the pressure in the mains to a maximum of seven pounds, without reducing the efficiency.

"To perfect the system we had yet to make automatic the manipulation of the compressor, in adjusting its speed to the constant pressure of 15 pounds required in the distributing tank. To do this we installed a combination speed and pressure governor, by which the pressure of the tank controlled the throttle of the engine.

"The changes described worked to perfection, and the result, namely, a saving of 45 per cent in fuel, was most gratifying. All of which goes to prove what I said above, that there is great opportunity for the use of expediency in operating a high-pressure distributing system."

Where the Busy Bee Causes the Gas-man to Get Busy.

"One section of our distributing system is operated under high pressure, one of the features of which is the installation of No. 1 equitable regulators for individual residence consumers, all regulators having a one-quarter-inch vent pipe run to a point of safety outside of the building,

regulators of a larger capacity being used wherever required. This system has been in operation for about one and one-half years, giving the best of satisfaction both to the consumer and the company; complaints of poor service being few and far between, and we had many times congratulated ourselves upon the wisdom and foresight that prompted this method of handling gas.

"We did, however, meet with one most peculiar experience, and one that for a short time bothered us somewhat. Complaint had been made that some of our consumers were getting a very meagre supply of gas, and in such cases our inspector ordered the regulator changed. This was done, and after testing, no better results were obtained. It was plainly demonstrated that gas in sufficient quantity was delivered to the regulator, that the regulator, meter and house-piping were in perfect condition, and apparently there was no good reason why we could deliver no gas at the stove. During the course of investigation the vent pipe was removed, and the result was a good supply of gas at the appliance. Upon examining the vent pipe a bees' nest was found contained therein that stopped it so completely as to prevent the working of the diaphragm on the regulator.

"I may add that the bees were of a miniature type, and that the few troubles of this nature were confined to a very small locality."

The next experience shows how it was proven that a mixture of crude oil and water does not make a healthy drink.

A Leaky Oil Tank.

"The writer has charge of a gas and electric plant in a city of about 3500 inhabitants.

"The plant is located near the business center of the town, on the main street, two blocks from the post office, and is adjacent to city property, upon which are located four of the wells supplying the city water.

"Previous to our advent the old gas works had been entirely renovated and a new system installed. While making this change quite a quantity of tar and other refuse products had been dumped into a trench near the city wells above mentioned.

"About the year 1903, in order to better our facilities for handling oil, a redwood tank was installed and placed about one foot under ground, at a point not over 30 feet from the wells. This tank held about 11,000 gallons of oil. The earth covering the top of the tank was kept moist to prevent any shrinkage. As the time passed, we began to notice a gradual loss of oil, and at last, receiving a car of high gravity oil, our loss per day ran up to over 100 gallons. This loss convinced us that something was wrong with our oil tank. On digging a trench around the tank, we found the iron hoops so loose that one could run his hand between them and the stays. The stays instead of running straight were curved in the center, and oil was oozing out of every crack, showing that the redwood had shrunken under the effects of crude oil.

"We overcame this trouble by having a galvanized tank made and placed inside the wooden one, and from that time forward we have noticed no loss of oil. In the meantime, the water consumers began to complain of oil in the water. Of course we laid it to the oil paint used by the water works in painting the inside the city water tanks. The complaints, however, came in so thick and fast, that the city board of health took the matter up, and we at last had to acknowledge that it was no doubt our oil or tar in the water. It was clearly shown that the city wells were not properly constructed, being provided with only a single casing, and there were old timers who volunteered the information that the casings of the wells had been punctured by the water company, in order to let in a surplus of water to increase the supply.

"The presence of oil, therefore, was a clear proof of the presence of surface water.

"The Secretary of the State Board of Health, upon investigating the oil trouble, remarked that he considered it a blessing that the oil reached the city wells, if only to prove that the surface water was contaminating them.

"Then the City Board of Trustees devised a scheme of stopping the inflow of surface water containing the oil; they decided to take out the suction pipes, and, after putting a flange around the bottom of each pipe, large enough to fit the casing, they replaced the suction pipes and filled the spaces between the pipes and casings with liquid cement. The first two wells thus treated proved a success, giving a supply of clear water with no trace of oil after the well had been once pumped out; the other two wells so repaired proved a failure, for, after repeated trials, oil and tar continued to appear in the water, and so numerous were the complaints that the city Board of Health condemned the wells and they had to be abandoned.

"About that time a new Board of Trustees, with a record to make, peremptorily demanded that the gas and electric company bore a new well of larger dimensions to replace the old wells contaminated by our oil and tar.

"We gracefully submitted, feeling just like one of the old martyrs suffering in a glorious cause."

And finally we have something almost humorous, which we may entitle

Woman's Intuition.

"A woman sent for an inspector, who arrived in due time and started toward the offending meter. But the woman informed him that all she wanted was an opportunity of telling him just exactly what she thought of him.

"'I appreciate that my next door neighbor may be a very attractive woman in your eyes,' she told him scathingly, 'but that is no reason why I should have to pay for her gas, just because you're stuck on her.'

"'Oh, I know,' she continued, 'I know that you have connected her house with my meter, and that I am paying for most of her gas. My bill is always about double her's, but I'm just giving you fair warning! That pretty face of her's is likely to get you into trouble, young man.'"

Respectfully submitted,

R. P. VALENTINE, Editor.

SPECIFIC GRAVITY IN A MINUTE.

By Frederick C. Jones.

The usual method of calculating the specific gravity of a gas from its analysis is to multiply each constituent percentage by its own specific gravity, compared with air, add the products thus obtained and divide the sum by 100.

Now, the specific gravities compared with air of the different gases making up illuminating gas are numbers running into decimals of four and five places, while the specific gravities compared with hydrogen are simple whole numbers as follows:

CO_2	22
C_2H_4, CO, N_2	14
O_2	16
H_2	1
CH_4	8

It is simple then to multiply the per cent of CO_2 by 22; add the C_2H_4, CO and N_2 together and multiply by 14, and so on, and then divide the sum of these products by 14.43, which is the specific gravity of air compared with hydrogen. This result divided by 100 gives the specific gravity of the gas when air equals 1.000.

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EDITORIAL.

The Board Of Fire Underwriters And The Electric Companies.

In many of the smaller cities great strides are being made toward the placing of all wires underground in the business section where previously overhead construction has been exclusively installed, and for a long time has been in use. Also in the larger cities the underground districts are very properly being extended. It is commonly believed by the average man, whose information is obtained almost entirely from the newspapers, that the electric light and power companies, and the telephone, telegraph and electric street railway companies, are doing all they can to defeat the efforts of the people in improving the appearance of the streets by requiring all wires to be put underground and the poles and overhead construction removed. But to those actually engaged in such work the real facts are known, namely, that in the majority of cases, the companies are willing to do all they consistently can in installing the more permanent, and in the end less expensive, underground systems to replace the older overhead circuits.

Our city fathers will do well to bear in mind that it is pretty nearly impossible for any company owning and operating from 50 to 200 miles of pole line, within one or even two years, to put all of its distribution wires underground. The necessary material to do such work could not be secured in many cases where the districts are very large, and in addition, the work could not possibly be done without seriously interrupting the service unless it were done in comparatively small areas at one time. Wires of every character should go underground, as the business sections of the cities increase in size, but the replacing of poles and wires with underground cables should be gradual, a certain amount each year, and this amount should be completed, and no excuses or extensions of time accepted under the most adverse circumstances.

The removal of the mains and feeders are not the only work each company must consider. Not the least part of the work is in connection with the changing of the customers' services from the old overhead lines to the new underground leads. In many buildings, especially the older ones, to make all the alterations required, and still comply technically with the rules of the Board of Fire Underwriters is absolutely impossible unless the owner of the property is put to great and often unnecessary expense. Conditions arise that were certainly never considered by the authors of many of the Electrical Code rules, and good common horse sense is necessary on the part of all to determine the best way to make all of the alterations incident to the change from the overhead to the underground services.

All new and permanent work should be done in the best possible manner, labor and material included, but to fit the new, better and safer services to the old wiring systems in many cases put in years ago, requires the best possible judgment and a thorough knowledge of the conditions existing in each individual case.

Certainly the lessening of the fire hazard from electric wires by removing the overhead lines on the streets should compensate to a large degree for the few instances of possibly unapproved construction which is practically unavoidable when the overhead service is discarded, and the underground connection from the street to the building substituted.

COPPER MARKET SITUATION.

Wide fluctuations have marked the course of the copper market lately, and the downward tendency of values has induced buyers to wait for settled conditions before placing heavy orders. The world's demand for copper has undergone a large and rapid contraction since January 1, and on that account the market has declined sharply within the past thirty days. From July 1 to September 7, Electrolytic Wire Bars have receded from 25¼ to 18 cents, and since the latter date there has been a further loss of 1½ to 2 cents per pound. Prices now quoted are 16½ asked. This reactionary course in prices has been the direct outcome of a heavy falling off in consumption and a high money market, and these factors have exerted their power in all their concentrated force upon the copper market.

As a result of present conditions, the total buying power for the last six weeks has proved utterly inadequate to sustain the semblance of stability, and prices have come down to the level of those of two years ago. The effect of recent developments and the striking events which have thrust themselves into the foreground are producing their legitimate result in the curtailment of business and the withholding of orders until the copper market gives unmistakable evidence of being on a firm foundation. Consumers of copper naturally have been conservative for some time past, and wisely so, but they will welcome the return to stability again by which they can secure a much bigger volume of business than is possible in the present unsettlement and uncertainty.

It is becoming more and more evident that capital must be in more plentiful supply before the industrial interests of the country will be put to work on the extensions and improvements now held in abeyance until the monetary stringency is relieved. The present slowing down in business should have the tendency of diverting capital into other channels, where it will be satisfied with more moderate returns on money invested in solid properties, rather than in those more hazardous enterprises which dazzle the investor with short-lived earnings of abnormal size. When money is in sufficient supply, at fair rates, it will be surprising if there is not a big expansion in business all along the line.

Improvement in the financial world would no doubt revive activity in electrical circles, where plans have had to lie dormant until the task of financing them successfully could be accomplished. On account of the suspension of much important electrical work, the demand for wire has fallen off greatly, and the copper market cannot expect to reach a permanently strong position before the wire users are ready to place large orders. With the under-consumption of wire and other finished metal goods there has been the simultaneous over-production of copper. The consequence of all this is that there is now a heavy accumulation of copper, which furnishes a strong argument in favor of the exercise of a most judicious conservatism among consumers. It will be necessary to work up the enormous floating supply before the copper situation will be in an absolutely sound condition. Curtailment of output or a shut-down of certain important mines is talked of, and it would seem as if the actual position called for some heroic remedy to prevent further demoralization. The situation will eventually cure itself, and we will again see active times in copper, but, meanwhile, the safest course to pursue is that of the utmost conservatism, carried out on a strictly cash basis. It is no time to take rash ventures or run big risks. —"Copper Gossip."

PERSONAL.

R. D. Holabird, of Holabird, Reynolds & Sayles of Los Angeles, Cal., has been in San Francisco during the past week.

Hunt, Dillman, Meredith & Allen, Inc., engineers, announce the removal of their offices on October 1st, 1907, to permanent location, rooms 907-912 Union Trust Building, San Francisco, Cal.

Members of a commission sent out by the German Government to investigate the electric power plants of the United States and Mexico, have been in San Francisco during the past week.

In the party, which is composed of some of the greatest electrical authorities in the world, are Privy Councilor G. Wittfeld, Department of Public Works of the Prussian Government; F. Jordan, Director of the Guilliaume Lahmeyer Electrical Works at Cologne and Frankfurt; Ph. Pforr, Director of the German General Electric Company, and F. Gutbrod, an electrical engineer in the service of the German Government.

CATALOGUES RECEIVED.

Bulletin No. 1098, from Fort Wayne Electric Works, illustrates and describes Type MPL Belted Generators for light and power. Modern design and construction for large railway stations or power plants for manufacturing establishments aim usually to have generators direct connected to prime movers. Cases frequently exist where it is not only practicable but good engineering to make use of belted generators. Several generators may thus be operated by the same engines by means of shafts and belts.

Bulletin No. 1100 shows the Fort Wayne Type L, small, direct-current motors for operating job printing presses, emery grinders, buffers, laundry equipment, coffee grinders, small pumps and many other small machines of general use, which require only a small amount of power, ranging from one-fourth to two horsepower at constant speeds.

Instruction Book No. 3028 details methods of installing and operating the Fort Wayne Type K, single-phase, integrating, induction wattmeters.

THE ELECTRICAL JOBBERS' AND MANUFACTURERS' OUTING.

Those interested in the manufacture and sale of electrical material in the vicinity of San Francisco, had a pleasant outing at Santa Cruz, on September 27, 28 and 29. The trip was replete with joy, including banquets, music and dancing, interspersed with trips to the Big Trees, and around Monterey Bay. The feature of the excursion was the six-inning baseball game between the Manufacturers and the Jobbers. The score, as recorded, was 22 to 22, but it is claimed that Frank Fowden, who refereed the latter part of the game, stole it for the Jobbers, and that the real score was 22 to 9. All who survived the severe course of dinners and swims, reached home late Sunday night, voting it an unqualified success. In our next issue we will show some interesting views of their antics.

PUBLICATIONS RECEIVED.

Holophane Company, 227-229 Fulton Street, New York City, send a new monthly, entitled "Holophane," that is filled with bright and interesting information regarding the Holophane system of illumination.

NOTICE OF REMOVAL.

The San Francisco News Company, on October 14th, 1907, will move to 747-749-751 Howard Street, San Francisco.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	SEPT. 27		SEPT. 28		SEPT. 30		OCT. 1		OCT. 2	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	....	80	....	80	....	80	....	80	....	80
2,250,000	M & S	Bay Counties Power Co. 5%	92½	....	92½	....	92¾	93½	92¾	93½	92¾	93½
1,000,000	F & A	Cal. Central Gas & El. 5%	....	100	....	100	....	100	....	100	....	100
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	70	75	70	....	70	75	70	75	70	....
900,000	J & J	California St. Cable Co. 5%	....	102½	....	102½	....	102½	....	102½	....	102½
2,000,000	J & J	Contra Costa Water Co. 5%	....	100½	....	100½	....	100½	....	100½	....	100½
1,000,000	J & J	do do Gen. Mtg. 5%	....	92½	....	92½	....	92½	....	92½	....	92½
623,000	F M A N	Edison Light & Power 6%	109	112	109	112	109	112	109	112	109	112
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	....	....	....	....	....	....	....	....	....	....
671,000	A & O	Geary St. Ry. 5%	60	....	60	....	60	....	50	80	50	80
610,000	M & N	Honolulu R. T. & L. Co. 6%	105	....	105	....	105	....	105	....	105	....
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	....	102½	....	102½	....	102½	....	....	....	....
500,000	J & J	Los Angeles Elec. Co. 5%	....	100	....	100	....	100	....	100	....	100
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	....	100	....	100	....	100	....	100	....	100
5,000,000	A & O	Los Angeles Ry. 5%	....	110¼	....	110¼	....	110¼	....	108	....	108
1,000,000	A & O	Los Angeles Lighting Gd. 5%	....	103	....	103	....	103	....	100½	....	100½
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	102¾	....	102¾	....	102¾	....	100¼	....	100¼	....
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	....	....	....	....	....	99	....	99	....	100
3,000,000	J & J	Market Street Cab'e 6%	105½	107¼	105½	107¼	105½	107	105½	....	105½	....
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	....	102	....	102	....	102	....	102	....	102
100,000	A & O	Mill Valley & Mt. Tamalpais S.Ry.5%	103	....	103	....	103	....	103	....	103	....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	112¾	....	113¼	113¾	113	114	110	111	110	111
1,498,000	J & J	North Pacific Coast R. R. 5%	....	101	....	101	....	101½	....	101½	....	101½
1,074,000	J & D	Northern Cal. Railway 5%	105	....	105	....	105	....	105	....	105	....
980,000	J & D	Northern Cal. Power Co. 5%	....	95	....	95	....	95	....	95	....	95
6,000,000	A & O	Northern Electric Co. 5%	....	97½	....	97½	....	97½	....	....	....	....
1,000,000	M & S	Oakland Gas Light and H. 5%	100	105	100	105	100	105	100	105	100	105
1,374,000	J & J	Oakland Transit Co. 6%	109	110	109	110	109	110	109	....	109	110¼
1,600,000	J & J	Oakland Transit 5%	102	....	102	....	101½	....	101½	....	101½	....
1,326,000	J & J	Oakland Transit Con. 5%	....	103	....	103	....	103	....	103	....	103
7,000,000	J & J	Oakland Traction Con. 5%	....	97½	....	99¼	....	99	....	99	....	99
1,500,000	J & J	Oakland Water Co. gtd. 5%	....	100	....	100	....	100	....	100	....	100
2,000,000	A & O	Omnibus Cable Ry. 6%	....	112	....	112	....	112	....	112	....	110
1,149,000	S D M J	Pacific Gas Imp. 4%	....	92½	....	92½	....	92½	....	92½	....	92½
8,494,000	J & J	Pacific Electric Ry. Co. 5%	....	103½	....	103½	....	103½	....	103½	....	103½
4,491,000	J & J	Pacific Light & Power Co. 5%	....	98	....	98	....	98	....	98	....	98
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	....	102½	....	102½	....	102½	....	102½	....	102½
350,000	J & J	Park & Cliff House Ry. 6%	....	104	....	104	....	104	....	104	....	104
250,000	J & J	Park & Ocean R. R. 6%	....	104	....	104	....	104	....	104	....	104
700,000	M & S	Powell Street Railway 6%	....	....	....	....	....	....	....	....	....	....
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	....	101	....	101	....	100	....	100	....	100
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	112¾	112¾	112¾	112¾	112¼	113½	110	....	110	....
3,000,000	J & J	S. P., Oak. & San Jose Ry. 5%	....	103¾	....	104	....	104	103½	103¾	103¼	103¾
1,500,000	J & J	do do 2d Mtg. 5%	....	....	....	....	....	....	....	....	....	....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	....	95	....	95	....	95	....	....	....	....
642,000	A & O	Sierra Ry. of Cal. 6%	105	110	105	110	105	110	105	110	105	110
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	101¼	101½	101¼	101½	101¼	....	101½	....	101½	....
4,000,000	J & J	do do do (1910)	....	....	....	....	....	....	....	....	....	....
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	108	....	108	....	108	....	105	....	105	....
4,127,500	M & N	S. P. R. R. of Cal., 1st c. gtd. 5%	112½	....	112½	....	112½	....	112½	....	112½	....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	....	125	124¼	126	124½	....	121½	....	121½	....
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	88¼	89	88⅝	....	88½	....	89¾	90	89½	....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	85	86	85	86	85⅛	86	86	86½	85¾	86¼
300,000	M & S	Stockton Gas & Elec. Co. 6%	....	105	....	105	....	105	....	105	....	105
2,000,000	J & J	United Gas & Elec. Co. 5%	....	....	....	....	....	....	....	....	....	....
20,000,000	A & O	United R. R. of S. F. 4%	69⅜	70¼	69⅜	70¼	69½	70¼	67	68	67	68
2,500,000	M & N	Valleys Counties Power Co. 5%	92½	....	92½	....	92½	....	92½	....	92½	....
		Water Stocks.										
....	....	Contra Costa	....	62	....	62	....	62	....	62	....	62
6,000	Quarterly	Marin County	45	....	45	....	45	....	45	....	45	....
280,000	....	Spring Valley Water Co	20½	21½	....	22	20	22	20	22	20	22
		Gas and Electric Stocks.										
37,500	....	Martel Power Co	....	....	....	....	....	....	....	....	....	....
9,340	....	Mutual Electric Light Co. (Ctfs.)	4½	....	4½	....	4½	....	4½	....	4½	....
37,336	....	do (Extended Ctfs.)	13⅜	....	13⅜	....	13⅜	....	13	....	13	....
40,000	Monthly	Pacific Lighting Co	65	....	65	....	65	....	65	....	65	....
12,000	....	Stockton Gas & Elec. Co	52	....	52	....	52	....	52	....	52	....
		Street Railroad Stocks.										
10,000	....	California	....	135	....	135	....	135	....	135	....	135
10,000	....	Geary	....	35	....	35	....	35	....	35	....	35
10,000	....	Presidio	....	25	....	25	....	25	....	25	....	25
	Semi-an.	Associated Oil Co	28½	29¼	28½	29½	28¼	28¾	27¾	28½	28	29
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry	....	110	....	110	....	110	....	110	....	110
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	81	85	81	85	80	83½	80	83½	80	81
180,000	....	Pac. Tel. & Tel. Co. (Common)	10	....	10	....	10	....	10	....	10	....

Unlisted Securities

750,000	A & O	Bay Counties Power Co. 6%	97	....	97	....	97	....	97	....	97	....
745,000	M & S	Blue Lakes Water Co. 6%	....	....	....	....	....	....	....	....	....	....
2,000,000	A & O	California Northwestern Ry. 5%	....	108	....	108	....	108	....	108	....	108
160,000	J A J O	Marin County Water 5%	....	100	....	100	....	100	....	100	....	100
600,000	J & J	Risdon Iron Works 5%	....	100	....	100	....	100	....	100	....	100
500,000	M & S	S. F. Dry Dock 5%	100	109	100	109	100	109	100	109	100	109
8,000,000	M & N	S. F. Gas & Electric 4½%	....	95	....	95	....	95	....	95	....	95
3,926,000	J & J	S. F. & North Pacific Ry. 5%	....	104	....	104	....	104	....	104	....	104
5,500,000	J & J	South Pacific Coast Ry. 4%	....	90	....	90	....	90	....	90	....	90
....	....	Standard Electric Co. 5%	....	85	....	85	....	85	....	85	....	85
....	....	do do Gtd. 5%	....	85	....	85	....	85	....	85	....	85
750,000	J & J	Sunset Tel. & Tel. Co. 6%	....	....	....	....	....	....	....	....	....	....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	....	103½	....	103½	....	103½	....	103½	....	103½
1,000,000	M & N	Sutter Street Railway 5%	....	103	....	103	....	103	....	103	....	103
		Stocks.										
50,000	Monthly	Gas Consumers' Association	17½	20	17½	20	17½	20	17½	20	17½	20
100,000	Monthly	Northern Cal. Power Co	24½	25	24	25	24	25	24	25	24	25
....	....	Pac. Gas & Elec. (Pfd.)	40	47½	40	47½	40	47½	40	47½	....	45
....	....	Santa Cruz Port. Cement	....	50	....	50	....	50	....	50	....	50
....	....	Standard Port. Cement (New)	40	50	40	50	40	50	40	50	40	50
$0,000	Monthly	Truckee Electric Co	....	15½	....	15½	14½	15¾	14	15	14	....

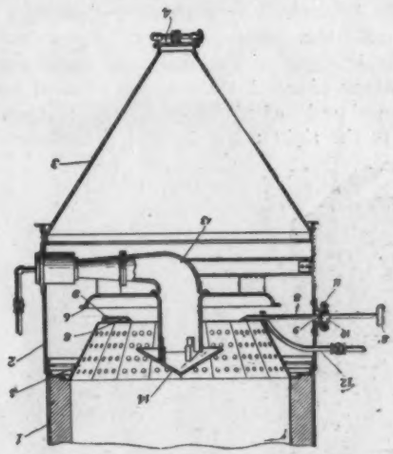
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

GAS-PRODUCER, 866,032. William B. Hughes, Cleveland, Ohio.

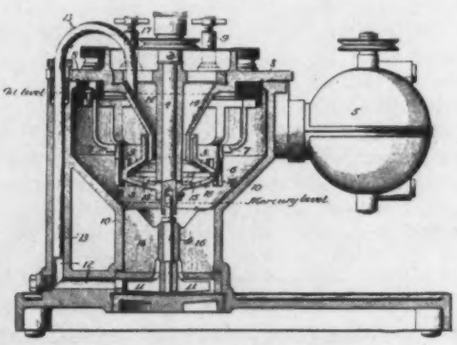
A gas producer having a body, a bottom casing depending therefrom, a water and ash basin in the casing beneath



the body, and a poker extending through the casing between the body and basin, poker being movable transversely to its length.

MERCURY-INTERRUPTER, 866,289. August R. Luschka, River Forest, Ill., assignor to Western Electric Company, Chicago, Ill., a corporation of Illinois. Filed December 11, 1905. Serial No. 291,206.

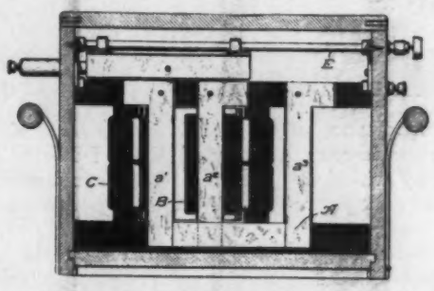
In a mercury jet interrupter, the combination with a rotary container having an opening in its periphery adapted to discharge the mercury in a jet therefrom, of a stationary



contact adapted to be struck by jet in its rotation, an inclosing vessel adapted to contain an insulating fluid and the discharged mercury, a centrifugal pump having an impeller wheel mounted to rotate with rotary container, pump having its inlet at the bottom of the inclosing vessel to withdraw the contents thereof, and a discharge pipe for pump adapted to direct the discharge either into rotary container to be used again or elsewhere to empty vessel.

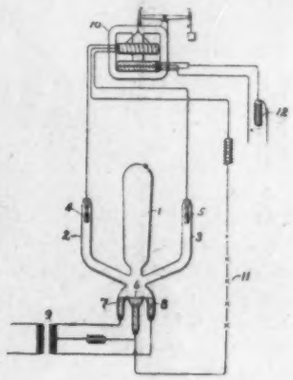
VARIABLE-VOLTAGE TRANSFORMER, 865,985. Thomas M. Bains, Jr., Philadelphia, Pa., assignor to General Electric Company, a corporation of New York. Filed February 8, 1907. Serial No. 356,478.

In a variable voltage transformer, a three-legged core,



a primary winding surrounding one leg, a secondary winding surrounding both the leg carrying the primary winding and a second leg, and means for directing the flux from the leg carrying the primary winding through the other two legs alternately.

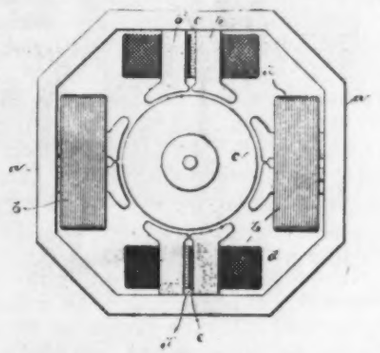
METHOD OF IMPROVING VAPOR ELECTRIC DEVICES, 866,011. Samuel Ferguson, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York. Filed February 9, 1907. Serial No. 356,555.



The method of improving the reliability of a vapor electric device for operation on a high voltage circuit, which consists in treating the rectifier with a relatively low voltage current to distil from the anodes any mercury which may have accumulated there accidentally.

ELECTRIC GENERATOR AND MOTOR, 866,286. Alvaro S. Krotz, Springfield, Ohio, assignor of one-half to Paul A. Staley, Springfield, Ohio.

In an electric machine, field magnets formed with two or more sections or legs, one or more of legs being pro-



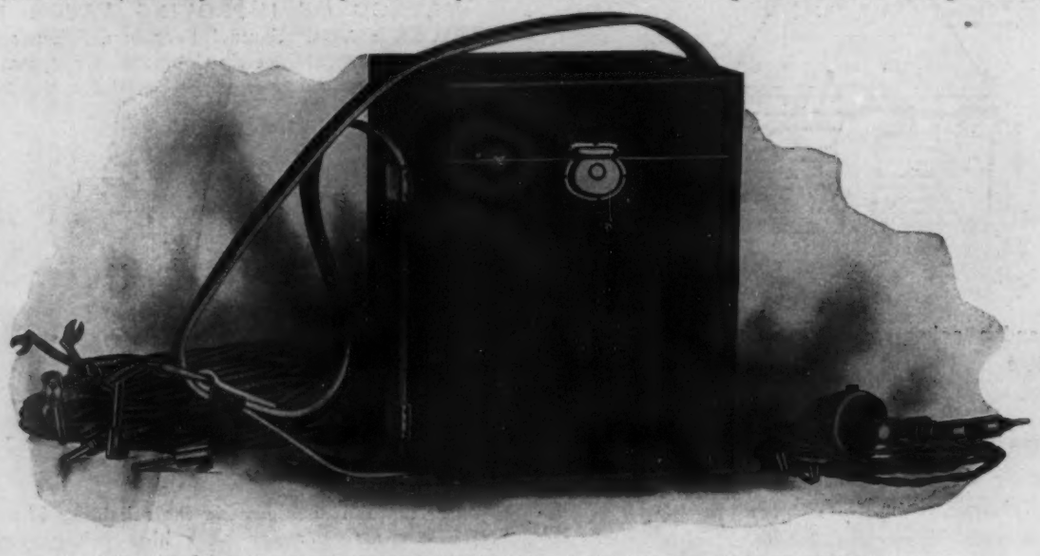
vided with additional coils and legs having the additional coils being of smaller diameter to compensate for the additional coils, and main coils extending around all of legs.

INDUSTRIAL

PORTABLE WATTMETER CALIBRATORS.

The importance of calibrating meters in service at regular intervals is recognized by all Central Station men, and a means by which this periodical calibration may be done quickly, without in any way impairing the accuracy of the result, is received with favor.

The ordinary method of calibrating meters is by the use of standard indicating instruments and a stop watch. While there is no question as to the accuracy of this method a much quicker method must usually be employed on account of the vast number of meters that are now in use. With the portable wattmeter calibrator such a method is provided. In the Type KM-1 calibrator, made by the Fort Wayne Electric Works, no stop watch is required, except in standardizing the instrument itself, nor is it essential that the load be constant. It is only necessary to observe the revolutions of the meter under test and the pointer indications of the calibrator before and after test, from which, by the use of the proper constants, the watthours registered by the meter under test and the calibrator may be determined. The calibrator is so designed that it covers the range of most meters in service from light to full load, for either 110 or 220 volts, two or three wire circuits. This is a very desirable feature in that it saves carrying more than one standard.



TYPE KM-1 PORTABLE WATTMETER CALIBRATOR WITH CURRENT AND POTENTIAL LEADS

The calibrator is enclosed in a mahogany carrying case provided with a carrying strap for use in transportation. The cover is hinged and provided with a lock which prevents tampering by unauthorized parties. The case is of a convenient size, the overall dimensions being 8x8x10¼ inches high.

The register is located on the top of the calibrator so that the pointer indications can be read by the operator, at a distance if necessary as in checking a meter installed close to the ceiling with the calibrator resting on the floor. The dial is 2¾ inches in diameter and provided with three pointers, the larger of which reads directly in revolutions, being connected directly to the shaft, and which in turn drives the units and tens pointers through the medium of two, 10:1 reductions. The periphery of the entire dial constitutes the tenths circle and is divided into ten large divisions, which in turn are sub-divided into ten smaller divisions, so that the pointer indications may be easily read to one-hundredth of a revolution. The units and tens circles are within the large circle, the former reading one revolution per division, and the latter reading ten revolutions per division.

The dial is covered by a suitable glass held in place by a spring brass ring.

Directly in front of the dial is a small knurled thumb screw by means of which the rotating element may be raised from the jewel and locked firmly in transportation. Turning this screw to the right raises the rotating element, and turning to the left lowers the rotating element. In making the adjustment in either case the screw should be turned to the limit.

The rear section of the top of the calibrator constitutes the terminal plate to which all connections are made. On this plate are located four current binding posts to which the current coils of the calibrator are connected. On this plate are also located plug switches by means of which the current capacities of the calibrator may be changed. The current coils (two in number) are wound in sections which may be connected in series or series parallel with the plug switches and in parallel with the plug switches in conjunction with the cable connectors on the current leads. Directly behind the plug switches are the potential receptacles, one for use on 110 volts and the other for use on 220 volts. These receptacles are provided with caps to prevent dust entering the interior of the calibrator when not in use. On this plate are also two, one-ampere fuses to protect the one-ampere winding from possible injury due to improper connections. To renew the fuse, withdraw the fuse plug from the receptacles, unscrew the cap and remove the contact washer and ring and insulating tube, which will give access to the fuse chamber. The new fuse may then be inserted by placing one end under the screw head in the lower end of the fuse chamber. Replace the insulating tube and

contact ring, and give free end of fuse wire one turn around top of contact ring. Replace contact washer on top of contact ring and screw cap down firmly.

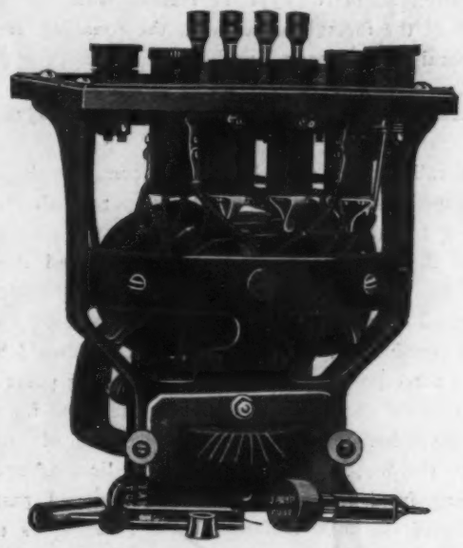
Each calibrator is furnished with a set of current and potential leads. On one end of each of the current leads is a small punched terminal for connection to the binding posts of the calibrator. These terminals are stamped with the distinguishing letters A, B, C and D, to aid in connecting the calibrator in circuit. The other ends of the current leads are provided with cable connectors stamped with the distinguishing letters M, N, R and S, to aid in obtaining proper connections when changing the current capacity of the calibrator and when connecting to the line. The potential leads are provided with a plug at one end for connection to the calibrator. The other ends of these leads have spring clips for connection to the line. In series with the leads is a pendant snap switch, by means of which the operator con-

TYPE KM-1 CALIBRATOR WITH COVER OPEN

trols the shunt circuit and rotation of the calibrator. One of the line connectors of the potential leads and one of the cable connectors of the current leads are stamped plus or minus and must connect to the same side of the circuit in order to obtain proper rotation of the calibrator.

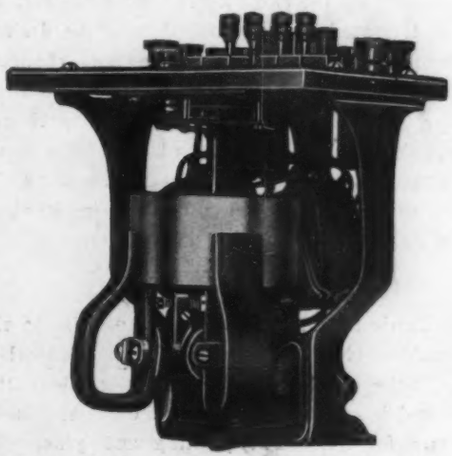
The top bearing is located in the top plate of the register and is easily accessible by removing the glass and pointer over the dial. The top bearing may then be readily unscrewed for inspection. The lower bearing consists of a cup diamond jewel mounted in a post set on a carefully selected spring to take up sudden jars which might be caused by setting down the instrument while the pivot rests on the jewel. The lower end of the shaft is provided with a removable pivot in order that the lower bearing may be replaced without replacing the entire shaft.

The entire calibrator may be lifted out of the case by removing the screw under the strap in the bottom of the case. The top plate is made of hard rubber in two sections, all of the connections being made on the rear section. This feature permits the removal of the register and rotating element without interfering with the connections. The shaft is made in three sections; the top bearing pivot, the shaft proper, and the jewel pivot. The joint of the top bearing pivot and main portion of the shaft is made just below the bottom plate of the register. To take out the rotating element it is first necessary to remove the jewel pivot. This is



TYPE KM-1 CALIBRATOR—BACK VIEW—REMOVED FROM CASE

accomplished by removing the jewel screw and inserting the combination wrench, which is furnished with the calibrator, and unscrewing the pivot (right hand thread). The top bearing pivot should next be unscrewed from the main shaft. This is done by loosening the check nut (left hand thread) with the combination wrench furnished with the calibrator. By holding the gear of the units circle of the register firmly in the fingers of the left hand and rotating the cup backwards the joint may be unscrewed and the entire register disconnected from the rotor. After this has been done the two retaining screws in the register plate and the entire forward section, complete with the register, can be lifted from the frame permitting the easy removal of the shaft and cup for inspection.



TYPE KM-1 CALIBRATOR REMOVED FROM CASE

The windings selected as most suitable for meter testing are 1, 2, 5, 10 and 20 amperes and 110 and 220 volts. With these windings meters up to and including 25 amperes, two-wire, either 110 or 220 volts, and up to and including 12½ amperes, three-wire, 220 volts, may be tested. The ampere turns of all the windings are equal, therefore, the

torque is constant when the meter is operating on a given percentage of full load for any of the different windings.

In checking the calibrator the same rules are followed as in testing standard Type K meters with the possible exception of the formula which with the constants furnished with the calibrator becomes:

$$\frac{3600 \times \text{Rev.} \times \text{Calibrating Constant}}{\text{Seconds}} = \text{Watts registered by Calibrator}$$

Each calibrator is furnished with a complete list of calibrating constants (reading in watthours per revolution) corresponding to the different capacities.

Place the calibrator in a level position and lower the rotor by means of a knurled thumb screw on the top. The rotor should always be raised in transportation. The current lead terminals stamped A, B, C and D, should be connected to correspond with the stamped binding posts on the calibrator, these connections to remain the same for all circuits. The other terminals of the current leads are connected to the meter under test and the line, according to instructions furnished with each calibrator and pasted on the inside of the lid. Different current capacities are obtained by plug switches, which are also fully explained in the instructions.

After making the proper connections for calibrator and meter under test, a reading of the dial should be taken. The calibrator should then be started simultaneously with the counting of the revolutions of the meter under test and stopped after the desired number have been taken. The pendant snap switch connected to the potential leads is provided for this purpose. The difference between the first and last reading of the calibrator gives the total number of revolutions. The watthours registered by both meters is the product of the revolutions and their respective calibrating constants. These constants being the watthours registered per revolution, therefore, the relative accuracy of the meter under test is shown by the ratio of the watthours registered by the two meters. After the test has once been started it need not be stopped until the desired number of revolutions have been taken as any change in the external circuit effects both the meter and calibrator the same. For the convenience of the operator, each calibrator is accompanied with a printed card transforming the calibrating constants marked on cups of standard Type K meters to calibrating constants reading in watthours per revolution so they may be used in this formula.

"The Curtis Steam Turbine-Generator," is the title of a large pamphlet (No. 4531), issued by the General Electric Company, Schenectady, N. Y., that is perhaps the most complete and handsomest publication ever sent out by any turbine manufacturer. The printing and general style of the pamphlet is very attractive, but will be found of a special interest to engineers on account of the information given with regard to superheat, vacuum, economy, etc., and the details of construction and operation of all parts of the Curtis apparatus. Under the heading of "Economy," detailed tests are given of 9000 kilowatt, 5000 kilowatt, 2250 kilowatt and 1000 kilowatt turbines, which show some very remarkable high efficiencies. The advance made by this type of turbine is illustrated by the maker's claim that nearly 1,000,000 kilowatts of Curtis steam turbine generators have been sold. Special attention is called to the flat efficiency curve, giving high efficiency at overloads and light loads, the simplicity of design, the low maintenance, the economy in space, etc. This publication seems to be typical of the recent desire to have such information written by and to engineers, and the following synopsis of its contents will show the wide field covered: Advantage of vertical-shaft type, economy of space, building materials and steam, clearances, flow of steam, balance, lubrication, the construction of buckets, governors, foundation, low pressure turbines, vacuum, regulation, parallel operation, ventilation, economy, etc. Of the illustrations, the following may be taken as having special interest: Those showing the interior of the Fisk Street station at Chicago and cross-sectional view of a 9000 kilowatt turbine, the method of cutting and riveting buckets, the hydraulic governor, low-pressure turbine sets installed and economy curves.

A motion for preliminary injunction was brought in the United States Circuit Court for the Middle District of Tennessee by the General Electric Company against the city of Nashville, Tennessee, to restrain the city from the further use of some alternating current generators manufactured by the Bullock Electric Manufacturing Company of Cincinnati, Ohio. These generators have laminated pole pieces attached to the revolving field spider by means of bolts from the spider engaging a transverse bar embedded in the pole piece, a construction covered by the Parcelle Patent No. 463,704, granted November 24th, 1891, which has been heretofore sustained by the Courts.

Judge Clark holds that the defendant has not produced any new matter tending to invalidate the patent and that, therefore, there is no reason why injunction should not issue, this patent having previously been held valid by the Court of Appeals for the Sixth Circuit of Cincinnati in the case against the Bullock Company on the same construction.

The court allows the city of Nashville sixty days in which to change the pole pieces or to withdraw the machines from use entirely.

TRADE NOTICE.

The Bristol Company, Waterbury, Conn., will build another new addition to their present plant. This addition is to be 53x170 feet, three stories high, and was made necessary by the increased demand for "Bristol's" recorders and "Bristol's" patent steel belt lacing.

THE AMERICAN BELL TELEPHONE CO.

Announce that all their telephone apparatus, manufactured by the Western Electric Company, Chicago, will, in future, be sold without restriction to the public.

The Western Electric Co., through their office at San Francisco, Seattle, and Los Angeles, are prepared to furnish printed matter and prices on the complete line.

SUSPENSION TYPE OF INSULATOR FOR HIGH VOLTAGE TRANSMISSION.

A new and unique design of high tension insulator has been adopted for the 150-mile, 100,000-volt, transmission of the Stanislaus Electric Power Company, in California. This

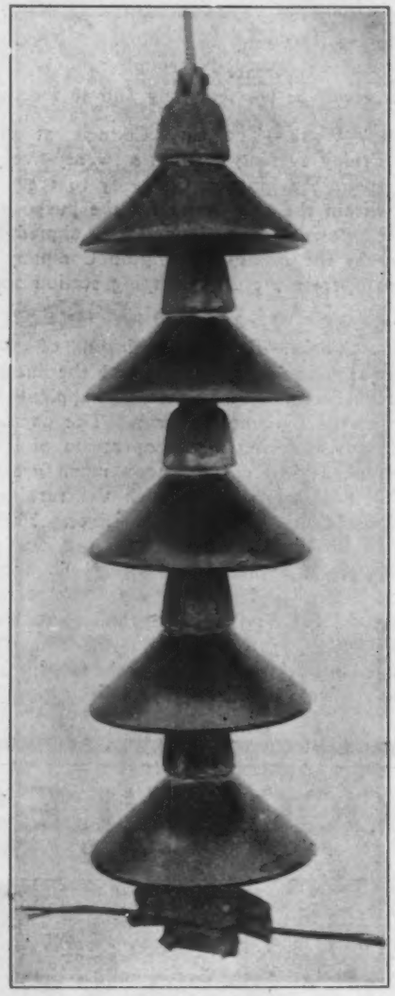


FIG. 2.—NEW HIGH TENSION INSULATOR.

insulator is well shown in the accompanying illustration (fig. 2), and consists of five units, each of which is made up of two pieces of porcelain—a short inner shell and an outer flaring one. One of the great advantages of this type of insulator is that the number of units can be increased or decreased at pleasure, and in addition, it is a comparatively easy matter for a lineman to carry extra parts in event of failure of one of the units in the insulator.

It has been demonstrated by exhaustive tests that the insulator will handle 100,000 operating line voltage with a considerable factor of safety. The shells are tested individually at a potential of approximately 60,000 volts before assembling, and the unit is tested at a potential in excess of 90,000 volts for a period of five minutes. With five units in series, and with an evenly divided rain of one inch in five minutes thrown at an angle of 45 degrees, it has been found that breakdown occurs at something over 250,000 volts.

It has been found that this insulator has an ultimate mechanical strength ranging from 10,000 to 12,000 pounds.

The design of this insulator was developed by Mr. J. V. E. Duncan, Electrical Engineer for Sanderson & Porter, New York City, and W. T. Goddard, Electrical Engineer for the Locke Insulator Manufacturing Co. Manufacture of the insulators is being undertaken by the Locke Insulator Manufactoring Company, Victor, N. Y., for whom Pierson, Roeding & Co. are Pacific Coast agents.

FIG. 1.—UNIT OF SUSPENDED INSULATOR.

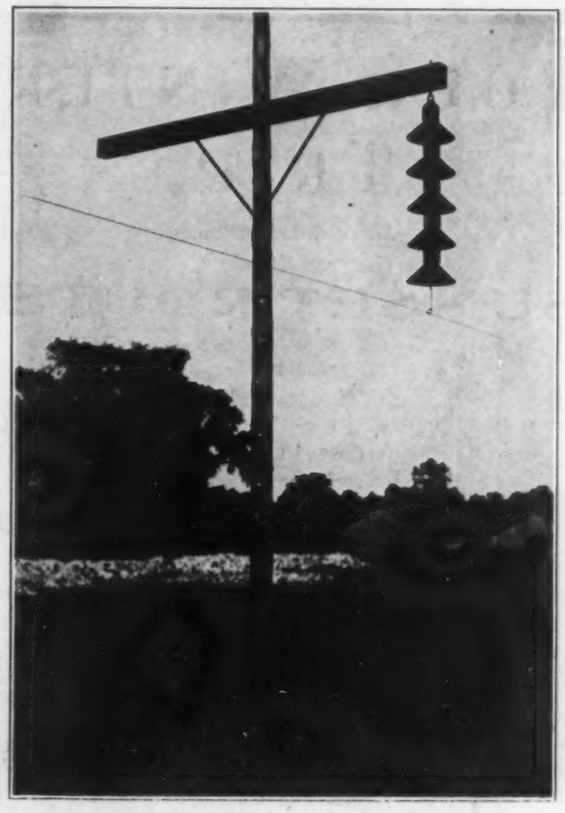


FIG. 3.—METHOD OF SUPPORTING TEST INSULATORS.

NEWS NOTES

LIGHT AND POWER.

Snohomish, Wash.—G. F. Goe is having a gas plant installed at Roosevelt for lighting purposes.

Cottonwood, Ida.—Cottonwood Water & Light Co., Limited, of Cottonwood, has been incorporated. Capital stock, $20,000; par value of shares, $50.

Prineville, Ore.—The Prineville Light & Power Company is contemplating installing a power plant on the Matoles next year to supply the whole county with electricity.

North Yakima, Wash.—The contract for the wiring of the Young Men's Christian Association building has been awarded by the building committee to the Northwest Light & Water Company.

Vancouver, B. C.—A flock of mallard ducks flew against high tension electric wires fifteen miles from the city. The current was short-circuited, $2,000 damages was done in the Vancouver power house, street cars and electric lights were put out of commission for twenty minutes.

Edmonds, Wash.—Council refused the application for an electric light franchise by outside parties. The application called for general privileges and franchise on an electric plant, and had been pending for several weeks. Whatever the reason for turning the application down may have been, it is pretty generally understood that with the advent of the car line, the matter of electric light will be pretty thoroughly taken care of.

St. Maries, Ida.—The Chicago, Milwaukee & St. Paul has commenced operations on a large dam at the mouth of Mica Creek, on the St. Joe River, near St. Maries, where the water will be furnished to supply electric power with which trains will be operated through tunnels in that section. The dam will be 900 feet long and 40 feet high.

Uniontown, Wash.—The City Council at its regular meeting last Friday evening granted a twenty-five year franchise to the Idaho-Washington Company to erect poles and string wires within the city limits for the purpose of transmitting electric power. The Council also signed a ten-year contract whereby the Idaho-Washington Company is to furnish power to operate the city pumping station and to light the streets.

Fairbanks, Alaska.—Supt. Hutchinson, of the Tanana Electric Company, has about completed the installation of the giant turbine engine, which is to supplant the steam power by which its dynamos are run. The company looks to a great economic saving in the operation of its plant by the new method, aside from having a much greater power capacity. The power house at which the turbine is being installed is located on the Chatanika River. The company is now fluming the Poker watershed to the new plant, and expects to develop a head of 5,000 miners' inches of water. The company has ordered an immense stock of motors and other equipment from Seattle, and promises to build power lines to any section of the Tanana, where operations are being conducted on a large enough scale to give promise of eventual financial returns to the company.

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